CLAIMS

I claim:

1. A fluxon injection system comprising:

an annular Josephson junction; and

current injection electrodes electrically connected to a superconducting electrode of the annular Josephson junction to form the flux injection system.

2. The system of Claim 1, wherein the annular Josephson junction is a long Josephson junction.

3. The system of Claim 1, wherein the annular Josephson junction is substantially circular in shape.

4. The system of Claim 1, wherein the annular Josephson junction is heart-shaped.

5. The system of Claim 1, wherein the annular Josephson junction has a Lyngby geometry.

6. The system of Claim 1, wherein the annular Josephson junction forms a qubit.

7. The system of Claim 1, wherein the annular Josephson junction comprises Nb/Al-AlO_x/Nb.

8. The system of Claim 7, wherein the annular Josephson junction has a mean diameter of approximately 100 μm and a junction width of approximately 4μm.

9. The system of Claim 8, wherein spacing between the injection electrodes is in a range from approximately 10 μm to approximately 22μ.

10. The system of Claim 1, wherein spacing between the current injection electrodes is between approximately a value of the Josephson penetration depth to approximately a width of the current injection leads.

11. A method of injecting at least one fluxon into an annular Josephson junction comprising:

providing current carrying injection electrodes electrically connected to a superconducting electrode of the annular Josephson junction; and,

delivering an injection current through the injection electrodes wherein the injection current has sufficient magnitude that the magnetic flux generated in the junction of the Josephson junction by the passage of the injection current therethrough is sufficient to create at least one fluxon in the Josephson junction.

12. The method of Claim 11, wherein the magnetic flux generated by the injection current is at least twice the quantum of magnetic flux.

13. The method of Claim 11, wherein the annular Josephson junction is a long Josephson junction.

14. The method of Claim 11, wherein the annular Josephson junction is substantially circular in shape.

15. The method of Claim 11, wherein the annular Josephson junction is heart-shaped.

16. The method of Claim 11, wherein the annular Josephson junction has a Lyngby geometry.

17. The method of Claim 11, wherein the annular Josephson junction comprises Nb/Al - AlO_x/Nb.

18. The method of Claim 17, wherein the annular Josephson junction has a mean diameter of approximately 100 μm and a junction width of approximately 4μm.

19. The method of Claim 18, wherein a spacing between the injection electrodes is in a range from approximately 10 μm to approximately 22 μm.

20. The method of Claim 19, wherein the injection current is between approximately 3 mA to approximately 10 mA.

21. A fluxon as an article of manufacture wherein the fluxon is produced according to the process of claim 11.

22. A plurality of fluxons produced according to the process of claim 11.

23. The method of Claim 11, wherein a spacing between the injection electrodes is in a range from approximately a value of the Josephson penetration depth to approximately a width of the current injection leads.

24 The method of Claim 11, wherein the annular Josephson junction forms a qubit.

25. A method of creating and destroying fluxons in a Josephson junction comprising:

providing current carrying injection electrodes electrically connected to a superconducting electrode of the Josephson junction; and,

delivering an injection current through the injection electrodes wherein the injection current has sufficient magnitude that the magnetic flux generated in the junction of the Josephson junction by the passage of the injection current therethrough is sufficient to create at least one fluxon in the Josephson junction; and

reducing the injection current to zero thereby returning the Josephson junction to a state without fluxons.

26. The method of Claim 25, wherein the magnetic flux generated by the injection current is at least twice the quantum of magnetic flux.

27. The method of Claim 25, wherein the annular Josephson junction is a long Josephson junction.

28. The method of Claim 25, wherein the annular Josephson junction is substantially circular in shape.

29. The method of Claim 25, wherein the annular Josephson junction is heart-shaped.

30. The method of Claim 25, wherein the annular Josephson junction has a Lyngby geometry.

31. The method of Claim 25, wherein spacing between the injection electrodes is in a range from approximately a value of the Josephson penetration depth to approximately a width of the current injection leads.

32. The method of Claim 25, wherein the annular Josephson junction forms a qubit.